**Original Article**

# The Clinical Characteristic and Management of Knee Osteoarthritis in the Outpatient Rehabilitation Department at Siriraj Hospital, A Descriptive Study

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## ABSTRACT

*Objectives:* To determine the relationship between demographic, clinical characteristics and management of patients with primary knee osteoarthritis

*Study design:* Retrospective chart review

*Setting:* Outpatient Rehabilitation Department of Siriraj Hospital

*Subjects:* 300 patients diagnosed with primary knee osteoarthritis.

*Methods:* Data was collected from the medical records of patients diagnosed with knee osteoarthritis (OA) knee with ICD-10 codes M17.0, 17.1, or 17.9 at Siriraj Hospital's Outpatient Rehabilitation Department in 2018, the year before the start of the COVID-19 pandemic.

*Results:* The study involved 300 patients diagnosed with primary knee OA. The mean age was 69.8 years (SD = 9.6) and 89% were female. The median BMI was 25.3 kg/cm$^2$. Most (67%) used civil servant medical coverage. Of the patients, 88.9% had bilateral knee pain and limited walking, and 66.9% of the patients who underwent roentgenographic study of the knees had early radiographic changes (Kellgren and Lawrence (KL) grades 0-1). The hospital records showed topical analgesics was the most commonly prescribed drugs (51.3%), followed by glucosamine sulfate (21.7%) which was associated with significantly milder radiographic changes ($p$ = 0.004). Half the patients received educational information on knee OA and advice on appropriate exercises. Provision of weight reduction advice was associated with patients with higher body mass index ($p$ < 0.001). Hospital-based physiotherapy was prescribed for nearly half the patients (43%). Non-pharmacological prescriptions were not significantly associated with radiographic severity.

*Conclusions:* The main characteristics of knee osteoarthritis patients in this study included obesity, elderly, female gender, civil servant medical coverage, bilateral knee pain, and mild radiographic severity. Weight reduction advice was given more frequently to patients with a higher BMI, and glucosamine sulfate was prescribed more often for patients with mild radiographic severity.

*Keywords:* *steoarthritis knee, clinical characteristics, management, glucosamine sulfate

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## Introduction

Osteoarthritis (OA) is a disease characterized by degeneration of the joints resulting in biomechanical and biochemical changes.[1] It is a common problem worldwide, and its prevalence is increasing in high, middle, and low-income countries.[2-4] According to global burden of disease studies conducted in 2017, knee OA was the third most prevalent disease in 2017, becoming a major health disorder and the second most frequent cause of disability globally.[5] In terms of years lived with disability (YLD), the percentage change in counts and age-standardized rates, in 2007-2017, knee OA was also the third from most common cause in the musculoskeletal disease group.[2, 5]

According to previous studies in Thailand, the prevalence of osteoarthritic is high, particularly in women, and increases with age.[3,4] Patients with knee OA experience knee pain, joint stiffness, swelling, deformity, and crepitus, leading them to seek hospital treatment. Interestingly, clinical presentations do not differ between rural and urban Thais, although urban patients have more treatment options.[6]

Healthcare utilization has dramatically increased as the world's life expectancy has increased, leading to more patients with knee osteoarthritis visiting healthcare providers.[6] Economic impacts of arthritis are high, particularly in Southeast Asia, including Thailand, where urbanization and population growth are driving increases in the prevalence of OA.[2, 7]

Treatment for knee osteoarthritis typically falls into three main categories: non-pharmacological, pharmacological, and surgical treatments.[1, 8] It is recommended that patients receive a combination of treatment modalities, including education, which is currently the core of international recommendations.[1, 8-11]

In Siriraj Hospital, knee osteoarthritis is the second most common problem in the outpatient rehabilitation clinic. The number of patients has doubled over the past decade, requiring more economic support. This study aimed to examine the

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amount of outpatient care provided by this department, including remedies used. The study aimed to approximate the annual resource utilization for the treatment of knee osteoarthritis and to determine the association between the radiologically measured severity of osteoarthritis and the prescribed treatment. This basic information can be used to monitor services provided and for resource utilization planning. This narrative study can also serve as a foundation for future studies in this field.

## Methods

### Study design

A retrospective chart review was conducted in a university hospital in Bangkok, Thailand, with approval from the Institutional Review Board, Faculty of Medicine, Siriraj Hospital (585/2564).

### Participants

Patients were eligible if they had been diagnosed with knee OA, with diagnostic codes of the International Classification of Diseases, Tenth Revision (ICD-10)[12] of M17.0 (Bilateral primary osteoarthritis of knee), M17.1 (unilateral primary osteoarthritis of knee), or 17.9 (Knee arthritis, unspecified), and were outpatients at the Rehabilitation Department, Siriraj Hospital between January 1, 2018 and December 31, 2018, the year before the COVID-19 outbreak. Data for 2019-2022 are not included in this study because the hospital services data for that period may not reflect routine hospital care practices.

All patients' charts were included if the data met the clinical criteria for knee OA knee developed by the American College of Rheumatology (ACR): pain in the knee plus at least three of the following: age > 50 years, stiffness < 30 min, crepitus, bony tenderness, bony enlargement, and no palpable warmth.[13] The exclusion criteria were preexisting conditions that can cause secondary arthritis, including trauma, infection, neoplasm, and metabolic diseases such as gout and hemochromatosis.

### Outcome measurements

The demographic characteristics of participants, including age, sex, health care coverage, body weight, and body mass index (BMI), were analyzed according to the WHO Asian body mass index reference.[14] BMI is divided into five groups: less than 18.5, 18.5-22.9, 23-24.9, 25-29.9, and 30 kg/cm$^2$ or more, representing underweight, normal, overweight, obesity, and extreme obesity, respectively. The study also assessed clinical characteristics such as knee pain, side of knee pain, history of functional limitation, signs of crepitus, and radiologic severity assessed using the Kellgren Lawrence radiographic grading scale[15] which was used for rating the severity of radiographic findings in this study: Grade 0 (none) definite absence of radiographic features, Grade 1 (doubtful) doubtful osteophyte lipping and possible joint space narrowing (JSN), Grade 2 (minimal) definite osteophytes, possibly JSN, Grade 3 (moderate) moderate multiple osteophytes, definite JSN, sclerosis, Grade 4 (severe) large osteophytes, marked JSN, severe sclerosis.

The types and number of treatments for each patient during each visit were identified and counted. Non-pharmacologic treatments included home-based and hospital-based physical therapy (PT), acupuncture, knee support, provision of gait aids, recommending specific exercise practices, weight control advice, provision of information about the nature of the disease and the joint protection program, and orthopedic consultation.[1,2]

Pharmacological treatments are divided into symptomatic rapid-acting drugs for osteoarthritis (SYRADOA), e.g., acetaminophen, oral nonsteroidal anti-inflammatory drugs (NSAIDs), topical analgesics (methyl salicylate cream), oral opioids, and the combination of acetaminophen and opioids.[8,9] Symptomatic slow-acting drugs for osteoarthritis (SYSADOA) include glucosamine sulfate, diacerein, and intra-articular injections such as intra-articular hyaluronic, steroids, and platelet-rich plasma injections.

### Statistical methods

The statistical analysis used R version 4.1.1. The demographic data was assessed for the normality of continuous variables distribution using the Kolmogorov-Smirnov test, with a statistical significance set at ≤ 0.05. Continuous variable data are presented as mean and standard deviation (SD) or median, while discrete variable data is expressed as a percentage. In addition, we used the Chi-squared test or Fisher's exact test to examine the relationship between discrete variables and radiologic severity grade.

## Results

Of 318 charts were randomly selected from the total 1,200 charts with coded M 17.0, 17.1, or M 17.9, the researchers confirmed that the data from 310 charts met the clinical criteria of knee OA developed by the American College of Rheumatology (ACR).[13] Ten additional charts were excluded because of wrong coding: no clinical data about knee OA or knee pain were found in those charts. No charts were excluded because of evidence of secondary knee osteoarthritis. Among the remaining 308 charts, another eight were excluded because of incomplete data (Fig.1). Of the 300 charts with complete data which met ACR clinical criteria of knee OA, 124 (41.3%) were coded M17.0 (bilateral primary osteoarthritis of the knee), 5 (1.7%) were coded M17.1 (unilateral primary osteoarthritis of the knee), and 171 (57.0%) were coded 17.9 (arthritis of the knee, unspecified).

### Characteristics of the participants

The study involved 300 patients who made a total of 809 visits to the outpatient rehabilitation department at Siriraj Hospital in 2018. All patients were diagnosed with primary OA knee. The mean age of the patients was 69.8 (SD=9.6), with 89% female and 11% male. The median BMI was 25.3

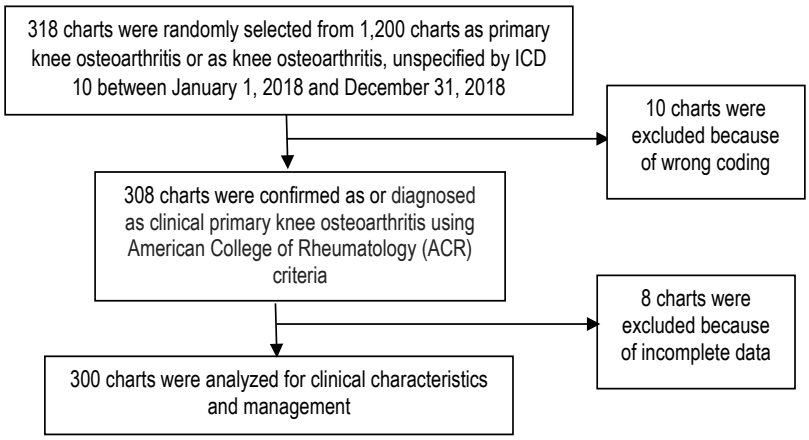


**Figure 1.** Chart review flow sheet

kg/cm$^2$, with 40.3% of patients being obese (BMI range 25-29.9 kg/cm$^2$). Most patients (67%) had civil servant medical benefit schemes as their health care coverage. Almost all patients (96.9%) experienced clinical knee pain. Most (88.9%) of the patients had bilateral knee pain and (92.6%) had crepitus. Most patients (86.1%) had functional limitations when walking. Over two-thirds of patients (68%) underwent a radiographic study, with most (69.9%) being classified as having Kellgren Lawrence (KL)[14] grade 0 or 1 (Table 1).

From the hospital records, topical analgesics (51.3%) were the most frequent pharmacological treatment, followed by glucosamine sulfate (22.3%) (Table 2). In addition, in almost half of the patients (42.7%), there were records regarding counseling on osteoarthritis knowledge. Over one-third were prescribed hospital-based physiotherapy as a non-pharmacological treatment (Table 2).

The association between the level of body mass index (BMI) and weight control prescribed by physicians was statistically significant ($p < 0.001$). For example, 21.1 percent of the patients with a BMI of 30 or more had a record of receiving weight reduction advice, while 2.5% of the patients with a BMI of 25-29.5 had a record of receiving advice.

The association between radiologic severity grading and treatment prescription is presented in Table 3. As analyzed by Fisher's exact test, glucosamine sulfate was statistically significantly associated with severity ($p = 0.004$). This drug was prescribed for patients with lower Kellgren Lawrence grades more frequently than for those with more severe grades. There was no significant association between radiological grading and non-pharmacological treatments, e.g., knee support, gait aid, and PT programs. (Table 3)

## Discussion

Knee osteoarthritis (OA) is a common degenerative joint disease affecting millions worldwide. Accurate diagnosis and appropriate management are crucial to providing effective treatment to patients. While clinical diagnosis based on symptoms, medical history, and physical examination can be reasonably accurate, radiographic imaging plays a vital role in confirming the diagnosis and assessing the severity of knee OA.[16]

This study included charts with the diagnostic code 17.9 (arthritis of knee, unspecified) for screening purposes based

**Table 1.** Baseline characteristics of patients (n = 300)

| Variable | Population Number (%) |
|---|---|
| Sex – female - number (%) | 267 (89.0) |
| Age (years) - mean (SD) | 69.8 (9.6) |
| Body weight (kg) - median (IQR) | 60 (54.7, 66.7) |
| BMI[16] (kg/cm$^2$) - change to number (%) | |
| < 18.5 | 4 (1.3) |
| 18.5-22.9 | 74 (24.7) |
| 23.0-24.9 | 63 (21.0) |
| 25.0-29.9 | 121 (40.3) |
| ≥ 30.0 | 38 (12.7) |
| Health care coverage - number (%) | |
| Civil Servant Medical Benefits Scheme | 200 (67) |
| Social security scheme | 28 (9) |
| Universal coverage scheme | 72 (24) |
| Clinical characteristics - number (%) | |
| Knee pain | 279 (96.9) |
| Side of knee pain | |
| One side | 28 (11.1) |
| Both | 224 (88.9) |
| Crepitus | 126 (92.6) |
| Functional limitations - number (%) | |
| Walking | 124 (86.1) |
| Sitting on floor | 2 (1.4) |
| Stair climbing | 11 (7.6) |
| Others | 7 (4.9) |
| Investigations - number (%) | |
| Radiographic study | 204 (68) |
| Severity (Grading by Kellgren Lawrence score[13]) | |
| Grade 0 | 22 (10.8) |
| Grade 1 | 120 (59.1) |
| Grade 2 | 54 (26.6) |
| Grade 3 | 7 (3.4) |
| Grade 4 | 0 (0) |

Km, kilogram; cm, centimeter

on the pilot study in which the researchers found that the officials responsible for assigning codes usually relied on the information in the patient's chart. In cases where the physician's notes indicated "right" or "left" knee osteoarthritis or knee arthritis without specifying "primary," the coding was classified as 17.9 (Knee arthritis, unspecified). To ensure greater accuracy of the results, the researchers reviewed the charts and applied the ACR criteria to confirm primary osteoarthritis of knee.

The analysis found that approximately half (57%) of the medical records with clinical data that met the ACR criteria for primary knee osteoarthritis contained the M 17.9 code (knee arthritis, non-specific). This finding suggests that at team meetings, physicians should emphasize the significance of using precise terminology within the coding system.

Acknowledging that coding is not infallible and can sometimes lead to inaccuracies or misinterpretations is essential. Therefore, it is crucial to exercise caution and consider the limitations of relying solely on coded data to determine the actual diagnosis. Additional measures, such as thorough chart reviews and clinical evaluations, may be necessary to ensure a more accurate diagnosis.

Among the 204 patients who underwent an X-ray examination, 22 cases exhibited negative findings (Kellgren Lawrence grade 0). Negative X-ray findings in knee OA patients can be the result of several factors. First, X-rays may fail to capture early-stage OA, where structural changes and joint space narrowing may not be evident.[17] In such cases, alternative imaging modalities such as MRI or ultrasound might be more sensitive for detecting early cartilage degeneration or soft tissue abnormalities. Second, patients with knee OA symptoms but negative X-ray findings could have other conditions mimicking OA, such as inflammatory arthritis, meniscal tears, or ligamentous injuries. A comprehensive clinical evaluation, including a detailed medical history, physical examination, and, potentially, additional diagnostic investigations, is crucial to identifying alternative diagnoses and ensuring appropriate management.

Regarding clinical characteristics, this study's results are similar to a previous study by Kuptniratsaikul on the epidemiology of OA knee among elderly patients residing in an urban area of Bangkok.[5] Our study found similarities in the average age, gender, and bilateral knee distribution of patients. This

**Table 2.** Pharmacologic and non-pharmacologic treatment (n = 300)

| Treatment | Number (%) (N = 300) |
|---|---|
| Pharmacologic treatment | |
| Acetaminophen | 23 (7.7) |
| Oral NSAIDs | 46 (15.3) |
| Topical analgesics | 154 (51.3) |
| Oral opioids | 6 (2.0) |
| Combined acetaminophen-opioids | 45 (15.0) |
| Glucosamine sulfate | 67 (22.3) |
| Diacerein | 0 (0.0) |
| Intra-articular corticosteroids | 0 (0.0) |
| Intra-articular hyaluronic acid | 0 (0.0) |
| Intra-articular platelet-rich plasma | 0 (0.0) |
| Non-pharmacologic treatment | |
| Advised PT home program | 17 (5.7) |
| PT program at the hospital | 129 (43) |
| Knee support | 49 (16.3) |
| Specific exercise practice | 113 (37.7) |
| Weight control advice | 14 (5.3) |
| Education | 128 (42.7) |
| Orthopedic consultation | 4 (1.3) |

NSAID, nonsteroidal anti-inflammatory drugs; PT, physical therapy

**Table 3.** Association between radiologic grading and treatment prescriptions

| | Grade 0 N = 22 | Grade 1 N = 120 | Grade 2 N = 54 | Grade 3 N = 7 | *p*-value |
|---|---|---|---|---|---|
| Pharmacologic treatment | | | | | |
| Acetaminophen | 3 (13.6) | 7 (5.8) | 4 (7.4) | 1 (14.3) | 0.317[a] |
| Oral NSAIDs | 2 (9.1) | 20 (16.7) | 8 (14.8) | 1 (14.3) | 0.893[a] |
| Topical analgesics (methyl salicylate cream) | 11 (50.0) | 64 (53.3 | 24 (44.4) | 5 (71.4) | 0.501[a] |
| Oral opioids | 2 (9.1) | 1 (0.8) | 0 (0.0) | 0 (0.0) | 0.079[a] |
| Combined acetaminophen-opioids | 2 (9.1) | 17 (14.2) | 7 (13.0) | 1 (14.3) | 0.98[a] |
| Glucosamine sulfate | 22 (100.0) | 28 (23.3) | 13 (24.1) | 4 (57.1) | 0.004[a] |
| Non-pharmacologic treatment | | | | | |
| Advice on PT home program | 2 (9.1) | 4 (3.3) | 4 (7.4) | 1 (14.3) | 0.174[a] |
| PT program at the hospital | 8 (36.4) | 60 (50.0) | 25 (46.3) | 2 (28.6) | 0.518[a] |
| Knee support | 2 (9.1) | 18 (15.0) | 12 (22.2 | 2 (28.6) | 0.35[a] |
| Gait aid prescription | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | - |
| Specific exercise advice | 8 (36.4) | 46 (38.3) | 20 (37) | 3 (42.9) | 1[a] |
| Weight control advice | 1 (4.5) | 9 (7.5) | 4 (7.4) | 0 (0.0) | 1[a] |
| Education | 12 (54.5) | 51 (42.5) | 25 (46.3) | 3 (42.9) | 0.751[a] |
| Orthopedic consultation | 0 (0.0) | 0 (0.0) | 2 (4.0) | 2 (28.6) | 0.06[a] |

[a]Fisher's Exact Test, NSAID, nonsteroidal anti-inflammatory drugs; PT, physical therapy
Values are reported as numbers (percentage)

finding may be due to the possibility that some patients visiting our clinic may have been from the Bangkok metropolitan area.

This study found that the most commonly prescribed medication was topical analgesics which accounted for half of the cases. Analysis of the association between radiologic grading and drug prescription found no statistically significant association ($p$ = 0.317). This finding may be due to doctors' concerns about the potential side effects of oral medications and the patient's preferences.

The second most commonly prescribed drug was glucosamine sulfate. We found a positive association between glucosamine sulfate and mild film grading (Table 3). In general, the effectiveness of glucosamine for knee OA remains a topic of debate. Some studies have suggested that glucosamine may provide pain relief and potentially slow down the progression of the disease, while others have found no significant benefits compared to a placebo. The conflicting results may be due to variations in study design, patient populations, dosages, and formulations of glucosamine. Guidelines from the American College of Rheumatology,[8] Osteoarthritis Research Society International (OARSI),[10] and the Thai Rheumatism Association[11] presented no substantial evidence supporting using glucosamine sulfate to improve OA knee and do not recommend glucosamine as a first-line treatment for knee OA.

Conversely, the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO) publications in 2014 and 2019, included a strong recommendation for the use of prescription crystalline glucosamine sulfate (pCGS) and chondroitin sulfate as step one in long-term background therapy for management of knee OA.[9,18] The combination of these treatments was only weakly recommend. A research article by Meng et al. published in 2022 reported that the combined use of glucosamine and chondroitin is effective and is superior to other treatments for knee OA.[19] However, the authors of that systematic study and meta-analysis also concluded that more studies are needed due to the uneven trial quality of the previous research. More high-quality trials are needed to further investigate the actual clinical advantages of the combination.[18]

While numerous studies have been conducted on glucosamine for knee OA, including randomized controlled trials (RCTs), more specific RCTs are needed that focus exclusively on patients with clinical knee OA with negative X-ray findings (KL = 0). The prescription of glucosamine sulfate for this group of patients should be reevaluated.

Further work is needed to identify specific reasons for choosing a given medication as various factors can influence the physicians' decision and thus affect patient outcomes. Patient requirements as well as physician beliefs and experience can influence the prescription of specific medications. Additionally, patients recently diagnosed with osteoarthritis knee have easy access to information on the latest technology, including medical knowledge, and may search for alternative medicines online.

Among the 809 medical records from 300 patients, there were no recorded cases of the use of more invasive therapy such as intra-articular steroid hyaluronic acid or platelet-rich plasma (Table 2). Similarly, there was no record of prescription of gait aids (Table 3), although that could result from the fact that most of the cases in this study had only mild knee OA.

Regarding non-pharmacological prescribing, including provision of patient education about the nature of the disease, joint protection programs, and exercise recommendations, the patient records show that half the patients received information on exercise (Table 2). However, failure to record provision of that advice may have resulted in underreporting the number of cases receiving such information. We found a statistically significant association between provision of weight control information and BMI. The records also show that physicians advised weight reduction for patients with a higher BMI ($p$ < 0.001) (Table 3)

Hospital-based physiotherapy was the preferred treatment for 43% of the 300 patients diagnosed with primary OA knee who had made a median of three hospital visits. Although more patients with mild radiologic severity came to the hospital for treatment than those with greater radiologic severity, there was no significant association between the level of severity and the number of hospital visits. A goal for the future is to reduce patient dependence on outpatient PT programs and to promote sustainable self-management of knee OA.[18]

As expected, patients who failed to respond to conservative treatments or who had severe radiologic grading were referred to the orthopedic department. This study found radiologic severity tended to increase the number of orthopedic consultations, but the association was not statistically significant.

There are several limitations to our study. First, numerous instances of information missing from an incomplete database may have resulted in less robust results. Second, poor handwriting may have resulted in some information being difficult to understand. Third, this study conducted only univariable analysis. Hence, the associations between two variables might be due to the effect of confounders. Another limitation is that data related to routine care from the 2018 chart review prior to the COVID-19 pandemic might be different from the routine care after the onset of the pandemic. Finally, our study was a retrospective chart review. Future prospective studies are suggested to improve the accuracy of the findings. We also recommend including pain scores, starting patient records at the first visit, maintaining the follow-up records, and specifying the quantity of medications. These information that could be valuable for future studies.

## Conclusions

This study found that patients in the rehabilitation department at Siriraj Hospital were predominantly elderly, female, obese, and had civil servant medical coverage. The most common clinical characteristics were bilateral knee involvement, limitation in walking, and mild radiologic grades (KL 0 and 1). The records showed that half of the patients received education on osteoarthritis, and that weight reduction advice was given to patients with higher BMI. The most common treatments were topical analgesics, glucosamine sulfate, and hospital-based physical therapy programs. Glucosamine sulfate was significantly more frequently prescribed in cases with milder radiologic severity. Non-pharmacological prescriptions were not significantly associated with OA knee severity.

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